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THE BROOD DISEASES OF BEES.

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In view of the widespread distribution of infectious brood diseases among bees in the United States, it is desirable that all bee keepers learn to distinguish the diseases when they appear. It frequently happens that an apiary becomes badly infected before the owner realizes that any disease is present, or it may be that any dead brood which may be noticed in the hives is attributed to chilling. In this way disease gets a start which makes eradication difficult.

There are two recognized forms of disease of the brood, designated as European and American foul brood, which are particularly virulent. In some ways these resemble each other, but there are certain distinguishing characters which make it possible to differentiate the two. Reports are sometimes received that a colony is infected with both diseases at the same time, but this is contrary to the experience of those persons most conversant with these conditions. While it may be possible for a colony to have the infection of both diseases at the same time, it is not by any means the rule, and such cases are probably not authentically reported. Since both diseases are caused by specific bacilli, there is absolutely no ground for the idea held by some bee keepers that chilled or starved brood will turn to one or the other of these diseases. Experience of the best practical observers is also in keeping with this. For a discussion of the causes of these diseases the reader is referred to Technical Series, No. 14, of the Bureau of Entomology, "The Bacteria of the Apiary, with Special Reference to Bee Diseases," by Dr. G. F. White.

AMERICAN FOUL BROOD.

American foul brood (often called simply "foul brood") is distributed thru all parts of the United States, and from the symptoms published in European journals and texts one is led to believe that it is also the prevalent brood disease in Europe. Altho it is found in almost all sections of the United States, there are many localities entirely free from disease of any kind.

The adult bees of an infected colony are usually rather inactive and do little toward cleaning out infected material. When the larvæ are first affected they turn to a light chocolate color, and in the advanced stages of decay they become darker, resembling roasted coffee in color.

Usually the larvæ are attacked at about the time of capping, and most of the cells containing infected larvæ are capped. As decay proceeds these cappings become sunken and perforated, and, as the healthy brood emerges, the comb shows the scattered cells containing larvæ which have died of disease, still capped. The most noticeable characteristic of this infection is the fact that when a small stick is inserted in a larva which has died of the disease, and slowly removed, the broken-down tissues adhere to it and will often stretch out for several inches before breaking. When the larva dries it forms a tightly adhering scale of very dark brown color, which can best be observed when the comb is held so that a bright light strikes the lower side wall. Decaying larvæ which have died of this disease have a very characteristic odor which resembles a poor quality of glue. This disease seldom attacks drone or queen larvæ. It appears to be much more virulent in the western part of the United States than in the East.

EUROPEAN FOUL BROOD.

European foul brood (often called "black brood") is not nearly as widespread in the United States as is American foul brood, but in certain parts of the country it has caused enormous losses. It is steadily on the increase and is constantly being reported from new localities. It is therefore desirable that bee keepers be on the watch for it.

Adult bees in infected colonies are not very active, but do succeed in cleaning out some of the dried scales. This disease attacks larvæ earlier than does American foul brood, and a comparatively small percentage of the diseased brood is ever capped. The diseased larvæ which are capped over have sunken and perforated cappings. The larvæ when first attacked show a small yellow spot on the body near the head and move uneasily in the cell. When death occurs they turn yellow, then brown, and finally almost black. Decaying larvæ which have died of this disease do not usually stretch out in a long thread when a small stick is inserted and slowly removed. Occasionally there is a very slight "ropiness," but this is never very marked. The thoroly dried larvæ form irregular scales which are not strongly adherent to the lower side wall of the cell. There is very little odor from decaying larvæ which have died from this disease, and when an odor is noticeable it is not the "glue-pot" odor of the American foul brood, but more nearly resembles that of soured dead brood. This disease attacks drone and queen larvæ very soon after the colony is infected. It is as a rule much more infectious than American foul brood and spreads more rapidly. On the other hand, it sometimes happens that the disease will disappear of its own accord, a thing which the author never knew to occur in a genuine case of American foul brood. European foul brood is most destructive during the spring and early summer, often almost disappearing in late summer and autumn.

TREATMENT OF INFECTIOUS DISEASES.

The treatment for both American foul brood and European foul brood is practically the same. It is impossible to give minute directions to cover every case, but care and common sense will enable any bee keeper successfully to fight diseases of brood.

Drugs.—Drugs, either to be given directly in food or to be used for fumigating combs, can not be recommended for either of these diseases.

Shaking treatment.—To cure a colony of either form of foul brood it is necessary first to remove from the hive all of the infected material. This is done by shaking the bees into a clean hive on clean frames with small strips of comb foundation, care being taken that infected honey does not drop from the infected combs. The healthy brood in the infected combs may be saved, provided there is enough to make it profitable, by piling up combs from several infected hives on one of the weakest of the diseased colonies. After a week or ten days all the brood which is worth saving will have hatched out, at which time all these combs should be removed and the colony treated. In the case of box hives or skeps the bees may be drummed out into another box or preferably into a hive with movable frames. Box hives are hard to inspect for disease and are a menace to all other bees in the neighborhood in a region where disease is present.

The shaking of the bees from combs should be done at a time when the other bees in the apiary will not rob and thus spread disease, or under cover. This can be done safely in the evening after bees have ceased to fly, preferably during a good honey flow. Great care should be exercised to keep all infected material away from other bees until it can be completely destroyed or the combs rendered into wax. Wax from diseased colonies should be rendered by some means in which high heating is used, and not with a solar wax extractor. The honey from a diseased colony should be diluted to prevent burning and then thoroly sterilized by hard boiling for at least half an hour, if it is to be fed back to the bees. If the hive is again used, it should be very thoroly cleaned, and special care should be taken that no infected honey or comb be left in the hive.

It is frequently necessary to repeat the treatment by shaking the bees onto fresh foundation in new frames after four or five days. The bee keeper or inspector must determine whether this is necessary, but when there is any doubt it is safer to repeat the operation rather than run the risk of reinfection. If repeated, the first new combs should be destroyed. To prevent the bees from deserting the strips of foundation the queen may be caged in the hive or a queen-excluding zinc put at the entrance.

Treatment with bee escape.—The shaking treatment may be modified so that instead of shaking the bees from the combs the hive is moved

from its stand, and in its place a clean hive with frames and foundation is set. The queen is at once transferred to the new hive, and the field bees fly there when they next return from the field. The infected hive is then placed on top of or close beside the clean hive and a bee escape placed over the entrance of the hive containing disease, so that the younger bees and those which later emerge from the cells may leave the hive but can not return. They therefore join the colony in the new hive.

Fall treatment.—If it is desirable to treat a colony so late in the fall that it would be impossible for the bees to prepare for winter, the treatment may be modified by shaking the bees onto combs with plenty of honey for winter. This will be satisfactory only after brood rearing has entirely ceased. In such cases disease rarely reappears.

In the Western States, where American foul brood is particularly virulent, it is desirable thoroly to disinfect the hive by burning the inside or by chemical means before using it again. This is not always practised in the Eastern States, where the disease is much milder. Some persons recommend boiling the hives or disinfecting them with some reliable disinfectant such as carbolic acid or corrosive sublimate. It is usually not profitable to save frames because of their comparatively small value, but if desired they may be disinfected. Great care should be exercised in cleaning any apparatus. It does not pay to treat very weak colonies. They should either be destroyed at once or several weak ones be united to make one which is strong enough to build up.

Recently some new "cures" have been advocated in the bee journals, particularly for European foul brood, with a view to saving combs from infected colonies. The cautious bee keeper will hardly experiment with such methods, especially when the disease is just starting in his locality or apiary, but will eradicate the disease at once by means already well tried.

In all cases great care should be exercised that the bee keeper may not himself spread the infection by handling healthy colonies before thoroly disinfecting his hands, hive tools, and even smoker. Since it takes but a very small amount of infected material to start disease in a previously healthy colony, it is evident that too much care can not be taken. In no case should honey from unknown sources be used for feeding bees. Care should also be exercised in buying queens, since disease is often transmitted in the candy used in shipping cages. Combs should not be moved from hive to hive in infected apiaries.

"PICKLE BROOD."

There is a diseased condition of the brood called by bee keepers "pickle brood," but practically nothing is known of its cause. It is characterized by a swollen watery appearance of the larva, usually accompanied by black color of the head. The larvæ usually lie on their

backs in the cell, and the head points upward. The color gradually changes from light yellow to brown after the larva dies. There is no ropiness, and the only odor is that of sour decaying matter, not at all like that of American foul brood. In case the larvæ are capped over, the cappings do not become dark, as in the case of the contagious diseases, but they may be punctured. So far no cause can be given for this disease, and whether or not it is contagious is a disputed point. Usually no treatment is necessary beyond feeding during a dearth of honey, but in very rare cases when the majority of larvæ in a comb are dead from this cause the frame should be removed and a clean comb put in its place to make it unnecessary for the bees to clean out so much dead brood.

CHILLED, OVERHEATED, AND STARVED BROOD.

Many different external factors may cause brood to die. Such dead brood is frequently mistaken, by persons unfamiliar with the brood diseases, for one or the other of them. Careful examination will soon determine whether dead brood is the result of disease or merely some outside change. If brood dies from chilling or some other such cause, it is usually soon carried out by the workers, and the trouble disappears. No treatment is necessary. Brood which dies from external causes often produces a strong odor in the colony, but wholly unlike that of American foul brood, merely that of decaying matter. The color of such brood varies, but the characteristic colors of the infectious diseases are usually absent, the ordinary color of dead brood being more nearly gray.

Approved:

JAMES WILSON,
Secretary of Agriculture.

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